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Natural History of Vermont.

AN

ADDRESS

DELIVERED AT BOSTON,

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BEFORE THE

BOSTON SOCIETY OF NATURAL HISTORY,

JUNE, 1850.

BY ZADOCK THOMPSON.

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ADDRESS.

Mr. President and Gentlemen of the Society:

When I received your kind invitation to appear before you on this occasion, I immediately wrote a reply, in which, after expressing my grateful acknowledgment of the honor done me, I respectfully declined it. In that reply, I stated that, although I had ever felt a deep interest in the affairs of this Society, and had at different times contributed a few trifling things, from my own neighborhood, to its collections, yet my diffidence and ignorance of what would be expected of me, would make me extremely reluctant to appear before it on this occasion, even if I could do it without having any fears of bringing discredit upon myself or upon the Institution. But when I considered the opportunities I had enjoyed, and my qualifications for this position, (or rather the want of them,) an acceptance of the invitation appeared to me to be little less than downright presumption: and I there stated that, for a person who had always resided, as I had done, among the Green Mountains of Vermont—who had never been so far from home as Boston, perhaps, a dozen times in his life—who had done what little he *had done* in the business of Natural History, without any associates engaged in like pursuits—without having access to any collections of specimens—and almost

without books; for a person, who had always been thus situated, to attempt to discourse upon the general subject of Natural History, before the Naturalists of Boston and vicinity, who have enjoyed years of mutual aid and intercourse, and who have been privileged with easy access to ample collections of specimens and books, appeared to me as absurd as would be an attempt of Le Verrier's new planet, Neptune, to illuminate the Sun.

Having delayed, for a few days, the transmission of this reply, and having in the meantime reflected somewhat upon the subject, I finally changed my determination, and concluded that, if it would be consistent with the occasion for me to confine my remarks principally to the sphere of my own observations—to the productions of my own neighborhood—and to the advantages and difficulties in the way of the cultivation of Natural History in newly settled country places, I would venture to accept the invitation. This change of my determination was not on account of any change of views of my own qualifications to discuss the general subject of Natural History, but because I thought it possible that I might say something respecting the productions of a country so little known as Vermont, which would be new and interesting to many of the members of this Society; and, if I failed in this, my very *failure* would confirm the truth of my statements in relation to *the difficulties in the way of the cultivation of Natural History in country places.*

The State of Vermont, in which I reside, being entirely without a sea-board, is, consequently, wholly destitute of that great and interesting variety of productions furnished by the ocean, with the exception of

those which are now only found in the fossil state. Hence, it could not be expected that Vermont would equal, in the variety of its fauna and botany, those neighboring States, which can number the marine with their terrestrial productions. Its settlement, too, took place at a period much later than that of any of the other New England States, and the people have, hitherto, necessarily, been so much occupied in clearing away the forests and providing the means of subsistence, as to allow them neither the time nor the advantages for scientific pursuits, which are enjoyed in the older States. Consequently, the number of those who have made any attempt to investigate our natural history has been exceedingly small, compared with the numbers engaged in like pursuits in other States. Hence, it would not be surprising, should it be found that Vermont has been less thoroughly explored than the neighboring States—those States, especially, in which legislative aid has been added to their other advantages.

The most prominent characteristic in the physical features of Vermont is the range of Green Mountains. These mountains, which give name to the State, extend through its entire length from south to north, and have an important relation to the various animal and vegetable productions. The two slopes of this range, one terminating in Connecticut river on the east, and the other in Lake Champlain and Hudson river on the west, are so dissimilar in their characteristic productions, that they may be regarded as two distinct provinces for the labors of the naturalist. While the eastern slope is, in its character, clearly identified with New England, the western exhibits, as clearly, the

characteristics of New York and the western States; and this distinction is more or less observable in all the three kingdoms of nature—in the rocks and minerals, in the vegetables, and in the animals.

The geology and mineralogy of Vermont have, during a few years past, received considerable attention. At the commencement of the geological surveys in the neighboring States, there were in Vermont a few individuals who were sufficiently acquainted with those subjects to be able to form a just estimate of the importance of such surveys, not only for advancing the cause of science, but for developing the resources of the country; and they no sooner saw them in the course of successful prosecution abroad, than they began to urge upon the Legislature of Vermont the advantages of a like survey of their own State. But a majority of our legislature, being unable to comprehend these advantages, or to foresee any benefits which would justify the expenditure that would be required for such a survey, refused for six or seven years to make any provision for it, although the subject was, in the mean time, urged upon their attention at each annual session of the Legislature.

At length, in 1844, a bill was passed, by a small majority, directing the Governor to appoint a State geologist to conduct a geological survey of the State, and making a small annual appropriation ($2000,) for three years, to defray the expense. A geologist was appointed, and the work was zealously prosecuted during the continuance of the appropriation; and I think I may say, without fear of contradiction, that as much labor was performed and as much investigation effected as were ever accomplished, with the same

expenditure, in any other State. But it was not possible, in the nature of things, that the whole State should be explored and the whole work accomplished in so short a period, with so small an annual appropriation. At the close of the three years there still remained some portions of the State which had not been examined, and other portions of which circumstances had rendered a re-examination desirable; and it was confidently expected that an additional appropriation would be made, sufficient to enable the State geologist to complete the necessary examinations, and prepare for publication a well digested, final report. But our Legislature have thought otherwise. They have now, for three annual sessions, since the survey was suspended, refused to make any further appropriations for that object, and most of the results of the labor performed seem likely to be lost to the State and to science. With the exception of what is contained in the brief annual reports, nearly all that remains is locked up, in short hand note, in the *field books*—in the *boxes* of untrimmed and unticketed specimens,—and in the *heads* of the State geologist and his assistants.

The Green Mountains have, for some years past, presented to geologists an interesting problem, which was—the determination of their geological age and character, and particularly the age and character of that portion of the western slope of these mountains which has been denominated the *Taconic System.* And as the larger part of this range of mountains was within the limits of Vermont, the attention of the geologists of the country was directed to the geological survey of that State, as being likely to furnish a satisfactory solution of the problem; and during the con-

tinuance of the survey, that object was kept constantly in view by those engaged in it. Many sections were traced eastward from the well known Silurian rocks, which occupy the valley of Lake Champlain, to the centre of the Green Mountain range, and many facts were brought to light which have an important bearing upon the problem which I have mentioned; but just as the examinations were being completed, and the results and facts were to be brought together, systematized and weighed, the survey was suspended; and whether it will ever be resumed or not, is a problem which time only can solve.

The rocks in the western part of Vermont, in the valley of Lake Champlain, are highly fossiliferous and clearly belong to that portion of the lower Silurian, denominated by the New York geologists the Champlain group. To the eastward of these, and mostly in the south part of the State, lie the so-called Taconic rocks. These last consist principally of slates, limestone,* and quartz rock. A few fossils are believed to have been found in them, but they are extremely rare and obscure; and the question with regard to these rocks is, as I understand it, whether they are a series of fossiliferous rocks which are older than the Champlain group, or are metamorphic members of that group, whose fossils have been mostly obliterated by heat.

To the eastward of the Champlain and Taconic groups, I am not aware that any fossiliferous rocks have been found, in place, within the State. Lying next to these, is a belt of talcose slate formation, varying

* The limestone of this series furnishes inexhaustible quarries of the most beautiful white marble.

from 15 to 30 miles in width, and extending through the entire length of the State from south to north. This belt embraces all the highest summits of the Green Mountain range. The rocks, though generally more or less talcose, contain, in many places, a large proportion of mica, and, in some places, are highly chloritic. Near the eastern margin of this belt there is a narrow range of steatite, extending through the State, having associated with it or embraced within it, in many places, extensive beds of serpentine rock, which are capable of furnishing, in great abundance, and of excellent quality, that beautiful variety of magnesian marble, called *Verd Antique.* In this serpentine, in the north part of the State, large veins of the magnetic oxyde, and also of the chromic iron, have been opened. The whole belt which I have mentioned, is entirely destitute, certainly in the north half of the State, both of limestone and granite.

Between this belt of Talcose rocks and Connecticut river, the formation consists of clay, slate, mica, hornblende, and talcose slates, gneiss and limestone frequently interstratified, and of numerous protrusions, and some extensive regions of granite. This granite is of excellent quality for building stone, but the limestone of this formation is all too siliceous for the manufacture of good quicklime.*

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* While all the western parts of Vermont abound in the best of limestone, there is in the eastern and north-eastern parts of the State no limestone from which good quicklime can be made. In the south-western part of Windsor county, and western part of Windham county, there is a gray limestone, and in the north-eastern part of the State are extensive beds of shell marl, which make a tolerable lime for ordinary purposes. These marl-beds were

One of the most marked peculiarities in the geology of Vermont, is found in the general dip of the stratified rocks, which is, with a few trifling exceptions, towards a synclinal axis extending north and south near the centre of the Green Mountain range. Along the shore of Lake Champlain the rocks are nearly horizontal, having only a slight easterly dip; but the dip increases pretty uniformly, in proceeding eastward, till it becomes vertical at a line a little westward of the principal summits of the Green Mountains. From this line, for a distance of seven or eight miles eastward, the dip of the strata continues nearly vertical. This space embraces the highest part of the mountain range, and, to the eastward of it, the general dip of the rocks is distinctly westward; but the rocks are here more disturbed, and the dip less uniform, than on the west side of the mountains.

With regard to the question, whether the rocks, which form the Green Mountains and extend eastward to Connecticut river, are truly primary, or antepalæozoic, as was formerly supposed, or are metamorphic silurian rocks, which are newer than the Champlain group, as has been more recently suspected, I would only observe, that evidence in favor of the latter

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originally formed in the bottoms of ponds; but these ponds have, in many cases, entirely disappeared, and the places they occupied became dry land. One of the most interesting of these marl-beds is in Williamstown. It covers about seven acres, and is in some parts 18 feet deep. It is a very pure carbonate of lime, consisting entirely of comminuted fresh water shells. This marl is formed into a paste, moulded in the form of bricks, and then burned in a kiln. The quicklime thus obtained is quite white, and for most purposes is scarcely inferior to that obtained from the Champlain and Taconic limestone.

opinion was constantly accumulating during the continuance of our survey, and has been greatly increased by the labors of Mr. Logan, the provincial geologist of Canada, along our northern boundary.

The rocks, in place, in Vermont, are, for the most part, covered by the drift formation; but wherever exposed, they are found to be worn and smoothed, and, usually, striated or scratched in the direction in which the drift materials have been transported, which is, generally, from a little west of north to a little east of south; but this direction is, in various places, very considerably modified by the direction of the ridges and valleys, being north and south in the lower parts of the valleys of Lake Champlain and of Connecticut river, but from north-west to south-east, and in some places nearly from west to east, in the valleys and gorges of the Green Mountains. Vermont furnishes many very interesting cases of the transportation of boulders to a distance of many miles from the quarries in which they originated. Rolled masses of a peculiar kind of granite, often of several tons weight, are found scattered over the lower parts of Caledonia county, from 20 to 30 miles to the south-eastward of the locality, in Orleans county, from which they were evidently derived, and blocks of a calcareous sandstone, found, in place, only along the shore of Lake Champlain, are met with far into the interior of the State, and, in some cases, to the eastward of the principal summits of the Green Mountains.* I mention these merely as exam-

* Some of these boulders are found resting at a level 50 feet or more above the highest parts of the same rocks as they are now found in place.

ples. Many other cases might be adduced of equal interest.

The unstratified drift in the western part of the State, and the Champlain rocks, are to a great extent covered by a post-tertiary marine deposit of stratified sand and clay, which has been called the *Pleistocene* formation. The strata of this formation are nearly horizontal, and are, for the most part, undisturbed and regular, showing that they were deposited in a tranquil sea. The depth of this deposit, in places, exceeds 100 feet, and the highest parts of it are about 400 feet above the present level of the ocean. The fossils found in it are considerably numerous, and are, in general, such as are now found in a living state on the coast of New England. The fossil bones of a small species of whale, which I had the pleasure to exhibit before this Society in December last, were found in this formation.

From the remarks which I have made, it must be obvious that Vermont combines in its geology the characteristics of western New England with those of New York. The meeting, in Vermont, of two great botanical and zoological districts or provinces, is equally apparent.

Vermont, for a small inland State, is regarded as peculiarly rich in vegetable productions; and some portions of the State have been pretty thoroughly explored by skiful botanists. When its settlement was commenced, its entire surface was covered with forests, which were probably unsurpassed, in density and luxuriance, by those of any other section of our country of equal area. The sugar maple and white pine found no where else a more congenial soil; and the ever-

greens, spruce, and fir, which covered the surface of our mountains, and first suggested for them the name of *Verd Mont*, grow to a respectable size almost to their highest summits, several of which exceed 4,000 feet in height. With the exception of seven or eight species, our list of forest trees embraces all that have hitherto been found in New England, and three, or more, species, which have been found in no other New England State.

Aside from the marine plants furnished by the seaboard, and a few alpine plants found on the White Mountains of New Hampshire, Vermont is known to produce nearly all of the indigenous plants of New England, and in addition to these, some 40 or more species which are not found in any other New England State. These 40 or more species, which are not found to the eastward of Vermont, are mostly confined to the western border of the State, and are, in general, such as are common in the State of New York, and further westward. As the botany of Vermont has yet been only partially explored, there still being considerable sections of the State which no skilful botanist has ever visited, it is not unreasonable to suppose that many *new plants* remain to stimulate and reward the labor of future search.

While the laborers in Vermont, in the fields of geology and botany, have been very few, those engaged in the investigation of the zoology of the State have been still fewer. The meagre account of our animals contained in Dr. Williams' valuable history of Vermont, until very recently embraced almost all that had ever been published respecting them. But that work was written at a very early period, when the subject of

Natural History, in this country, was little understood, and when an examination of the State, to which it relates, had hardly been commenced. In that work, (although the attempt to assign to our animals and vegtables their scientific names, was a failure,) he collected together from the hunters and early settlers, much that is valuable in relation to the magnitude, habits, &c., of our larger animals, and saved from oblivion many facts which are no where else preserved.

After the publication of Dr. Williams' history, the last edition of which was issued more than 40 years ago, nothing further was published respecting the Natural History of the State, excepting a catalogue of Vermont minerals by Prof. Frederick Hall, and a catalogue of the plants of Middlebury and vicinity, by Dr. Edwin James, previous to the publication of my Natural and Civil History of the State, in 1842. Having, myself, devoted considerable attention to the *vertebrata* of the State, and being kindly aided in the department of botany by the late William Oakes, Esq., of Ipswich, Mass., and in conchology by Prof. C. B. Adams, then of Middlebury College, with occasional assistance in other branches of zoology, kindly rendered by members of this Society, I was enabled to embrace in that work nearly all that was then known of the Natural History of the State. Since the issue of that work, much more has been done, and many facts accumulated, which have not been made public, and still the investigation of some branches of the Natural History of Vermont is not yet commenced.

Quadrupeds and birds possess such facilities for locomotion, that they could not be expected in Vermont to differ much from those of the neighboring States.

The number of species of our native quadrupeds, which have been carefully determined, is, at least, 45; and of birds more than 160 species have been ascertained.

Our largest native quadruped, the Moose, which grew to the size of an Ox, and whose flesh furnished to our early settlers an excellent substitute for beef, is now, if not entirely exterminated, confined to a small section in the northeast corner of the State. The Beaver, whose skin was once an important article of export, is wholly extirpated. The Panther, the Wolf, the Wolverine, the Deer, the Bear—in short, all the larger species, have been gradually diminishing, and most of the kinds have become exceedingly rare. The native black Rat (*Mus Americanus*) has vanished, but the *immigrant* gray Rat, (*Mus decumanus*) has, in some parts of the State, usurped its place, and has become a great nuisance. Yet it is a curious fact that there is, in the north part of the State, an extensive region, which has been settled more than half a century, in which, it is said, no rats were ever seen.

In the birds of Vermont, considerable changes have taken place, since the settlement of the country, in the number of individuals of the same species, at different periods; and there have probably been also a withdrawal of some species and the substitution of others. Of some species, which abounded when the country was new, an individual is now seldom, or never seen; while other species, which were then unknown, have become exceedingly common. The American Crossbill, (*Loxia curcirostria*) and red-headed Woodpecker, (*Picus erythroephalus,*) may be mentioned as exam-

ples of the former, and the Cliff Swallow, (*Hirundo fulva*,) of the latter. Forty years ago, as I well remember, the red-headed Woodpecker was one of the most common birds in our forests; but it is now so rare that, while I have travelled extensively over the State, I have hardly seen half a dozen in the last 20 years. On the other hand, I cannot learn that a Cliff Swallow was ever seen in Vermont till about the year 1817; but they now swarm in hundreds, about the eaves of barns in various parts of the State.

While the species of the two higher classes of the vertebrata of Vermont are, generally, the same as in the other New England States, the case is quite different with regard to the reptiles and fishes; so much so, that, in reference to these, the Western part of Vermont clearly belongs to a different zoological district from the eastern, and from the other parts of New England. The dividing line between these districts is along the summits of the Green Mountain range, which separate the waters falling into Connecticut river from those which are tributary to the St. Lawrence. The reptiles and fishes found in Vermont to the eastward of this line, are such as are common in other parts of New England, while those found to the westward of it, are generally different, corresponding, for the most part, with the fauna of Western New York. Of the reptiles found in the western part of Vermont, which are not, so far as I am informed, found to the eastward of the Green Mountains, may be mentioned the *Emys geographica*, the *Trionyx ferox*, the *Rana horiconenses* and the *Menobranchus maculatus*. Our Ribbon Snake, if identical, as it probably is, with the Coluber Sauriter of the eastern part of New England, often far exceeds

in length the measurement of this species usually given in books.*

But the fishes on the two sides of this dividing line differ even more than the reptiles. The whole number of species of Vermont fishes is about fifty. Of these, more than forty species are pretty well determined; and of those determined, not more than four or five are common to the two sides of the Green Mountains. There are perhaps seven or eight species, which are found on the east side of the mountains and not on the west, and at least thirty species on the west side, which are not found in any Vermont waters on the east side; and more than twenty of these thirty species are not, so far as I am informed, found in any other New England waters. Of these twenty or more species not found to the southeastward of western Vermont, *six* belong to the Perch family, *four* to the Salmon family, *three* to the Herring family, *two* to the Pike family, *two* or more to the Carp family, *one* Cottus, *one* Corvina, *one* Catfish, *one* Eel, and *one* Sturgeon.†

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* The largest individual which I have seen, of this species, I found near Lonerock Point, in Burlington, in 1845. It had been killed a short time before I found it, and about one half of the tail had been broken off and was missing. The remainder measured 35 inches, and the body was a little more than one inch in diameter. The tail in this species being about one third the total length, the whole length of the individual measured, must have been about 42 inches. This snake is quite common in the low grounds about the mouths of rivers and streams in the vicinity of Lake Champlain, but is never found upon the highlands, nor at any considerable distance from the lake.

† The following are the species:—Lucio-perca Americana, L. grisea, Centrarchus fasciatus, C. æneus, Etheostoma caprodes, Percopsis pellucida, Salmo amethystus, S. confinis, Coregonus

The Mollusca of Vermont have, by the labors of Prof. G. W. Benedict and Prof. C. B. Adams, been pretty thoroughly examined, but hardly any attention has been given to the other classes of our invertebrated animals. There are, I believe, a few species of fresh water Mollusks, in Lake Champlain, which have been found nowhere else, and a considerable number of species which are not found to the eastward of the Green Mountains. One of these last, is the Limnæa megasoma; and the only known locality of this species in Vermont is in Burlington, where they have sometimes been found plentifully in a few small creeks in low stages of the water, but from which it is feared they will soon be exterminated by the drying up of the creeks, in consequence of their having become exposed to the sun and winds by the removal of the forest trees and shrubbery which protected them.

Having given this brief and imperfect sketch of the present condition of natural history in Vermont, I proceed to a few general remarks respecting the cultivation of natural history in country places. One very important advantage for the cultivation of natural history in a new country, during its transformation from dense and unbroken forests to cleared and cultivated farms, arises from the opportunity it affords for observing the original distribution of plants and animals, and noting the manner in which that distribution is affected in consequence of the changes wrought by human agency. Even within the narrow limits of Vermont, the chan-

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albus, C. artedi, Hyodon clodalus, Lepisosteus oxyurus, Amia calva, Esox estor, E. nobilior, Catystomus cyprinus, Hydrargara fusca, Cottus gobioides, Corvina ascula, Pimelodus nicricaus, Anguilla vulgaris, and Acipenser rubicundus.

ges in the distribution of the animals, since the settlement of the State was commenced, have been of a marked and decided character. These changes in the two higher classes of the vertebrata, have already been alluded to. They are equally great in the two lower classes, particularly in the fishes.

When the first settlements were made in Vermont, and for many years afterwards, the noble Salmon (*Salmo salar*) abounded in Connecticut river and in Lake Champlain, and in all their principal tributaries. And where is it now? Not a solitary individual has, to my knowledge, been observed in our waters for many years. When the country was new, almost every stream in the State literally swarmed with brook trout (*Salmo fontinalis*). This was true in many parts, even within my own recollection; and in the smaller streams among the mountains, this was almost the only fish ever seen. But they have now nearly all disappeared from the older parts of the State, and their place is, in some measure, occupied by a few small and worthless species of Cyprinidæ. The ponds also abounded in trout, which, with those from the streams, furnished an important part of the sustenance of the early settlers. But these early settlers, not content with the natural distribution of our fishes, sought to improve it by the introduction of the voracious pickerel into these trout ponds; thus securing their aid in the extermination of the delicious trout, and in depriving themselves of that rich boon which Providence had provided for them; and these pickerel were not slow in performing the work of destruction.

In most new countries there are circumstances connected with the origin of the streams, which greatly

facilitate and extend the range of those species of reptiles and fishes whose *habitat* is chiefly in springs and small brooks. Where the grounds are covered with dense forests, which prevent evaporation from their surface, and with logs and leaves, which prevent the waters from passing quickly off into the streams, it is quite common to find, not in level countries only, but in mountainous regions, two, or more, streams originating from the same swamp, or pond, or fountain, and running off in opposite directions, and through different large rivers, to the ocean. Several cases of this kind are well known to have existed among the Green Mountains in Vermont, through which trout and other small fishes, and reptiles, might pass without difficulty from one side of the mountain to the other—from the tributaries of the Connecticut into the tributaries of Lake Champlain, and *vice versa*. One of the most remarkable of these was in Williamstown, near the centre of the State. The lowest summit level between Connecticut river and Lake Champlain is in that town, in a considerable valley, extending nearly north and south through what is called the *height of land*, and is 908 feet above the level of the ocean. From the eastern slope, which forms one side of this valley, and directly against the summit level, there descended into it a considerable trout stream; but just before this stream reached the highest point in the bottom of the valley, towards which it was tending, it divided itself naturally into two nearly equal parts, one of which flowed southward, through White river, into the Connecticut, and the other northward, through Winooski river, into Lake Champlain; thus opening to fishes of considerable size an easy communication between the two slopes of the Green Mountains.

The pickerel, not delighting in the cold spring water of the highland streams, appear never to have availed themselves, as they probably might have done, of these facilities for inter-communication; for the species are well known to have been originally unlike on the two sides of the mountains—the *Esox reticulatus* being confined to the east side, and the *Esox estor* to the west side. The *estor*, it is true, is now found in Connecticut river, and is taken somewhat plentifully at Bellows Falls; but it is equally true, that he found his way there by human means, and in modern times. Pickerel were taken from the west side of the mountains and placed in a pond, on the east side, in the south part of Windsor county, whose outlet is a tributary of the Connecticut. From this pond they descended into the Connecticut, where they have multiplied, and are now often taken weighing several pounds.

The *estor* in the Connecticut is distinguished from the indigenous pickerel by the vulgar name of Pike. On the west side of the mountains it is everywhere called the pickerel, or lake pickerel, by those who are aware that it is a different species from the *reticulatus*, or common pickerel of New England; and a fish of the perch family, the American pike perch (*Lucio-perca americana*) is there generally understood by the vulgar name of pike.

In comparing specimens of the *E. estor* from Connecticut river with those from Lake Champlain, it has appeared to me that there is a perceptible difference in their general form and aspect, while at the same time they are known to be identical in species. A like general difference is observable in the *E. reticulatus* from different ponds, and also in the brook trout and some

other species of fishes; and this difference is often so marked, that people in the country, who are familiar with several localities, profess to be able to designate the locality from which specimens were derived, from the general aspect of the fish. These facts plainly show that very considerable variety may be produced in a species by local circumstances; and since the variation may often be so increased by accidental peculiarities in the individuals, which are the progenitors of the species in the new locality, it has appeared to me that naturalists should be more cautious than they seem sometimes to have been, in founding new species upon variations, which might be supposed to have arisen, in any way, from individual peculiarities, change of habit, or local circumstances, or from all these causes combined. But this is a subject upon which, perhaps, on account of the limited sphere of my observations and knowledge, it is not becoming in me to express an opinion.

Another very important advantage afforded by the country for the cultivation of natural history, consists in the opportunity which the country furnishes for observing the various productions in their natural relations to their localities. Plants may be studied by the aid of books, and drawings, and herbals, and botanic gardens; but how imperfect must be the knowledge acquired by the help of all these, without the advantage of observing their growth in their native soil—in the localities where they were planted and reared by their Creator's hand! And so too of the various tribes of animated beings. They may be studied in books, and museums, and menageries, to very little purpose, unless they are also studied in the natural conditions,

and elements, and relations, in which the God of nature placed them. These last it is which constitute the most interesting, instructive, and important part of their study.

Another advantage for the study of natural history possessed by those who reside constantly in the country, arises from the opportunity furnished for observing the various indigenous productions through all the seasons of the year, and through all their periods and stages of growth and decay. The natural history of vegetables can be well understood only by observing the soil, the seed, the germination, the growth, the leaves, the flowers, the fruits, the structure and the decay; and the study of these requires their constant presence and a continuous series of observations. And the same is true of the animal kingdom, and especially of the animals of the lower order. What could we learn of the natural history of an insect by observing it in only one of the stages of its existence? To obtain a knowledge of its history, it must be studied in all its stages. The egg, the larva, the pupa and the imago, all these—their developement, growth, food and habitat, from stage to stage;—all these must be carefully observed, in order that its complete history be understood. And what class of men is so favorably situated for making these observations as our agriculturists—our farmers who reside in the country, and spend a large proportion of their time in the fields, and in places where these various processes and metamorphoses are constantly going on before their eyes?

Such are the advantages which country places offer, and which those who reside in the country might enjoy; but we find them almost universally unheeded. The

varied and beautiful operations of nature are constantly going on; but they are almost unobserved and unknown by the thousands in whose immediate presence they are occurring, and to whom they might become not only the source of rational and enduring pleasure, but of high intellectual and moral improvement. It may not, therefore, be amiss to advert briefly to the causes of this indifference and apparent neglect of these advantages. The chief causes of the general indifference to the subject of natural history in country places, and to the beauties and harmonies of the material world, as it appears to me, lie in the defects of early education, and the want of suitable books and instrumentalities for the successful practical cultivation of the natural sciences.

It is well known that all children are interested and delighted with the objects of natural history; and hence it is that parents resort to the representatives of these objects—to pictures of beasts and birds, and fishes and flowers, as the most convenient and effectual means of pacifying and amusing their children. And is it not reasonable to conclude, that this disposition to be interested and pleased with the productions of nature, which is thus manifested in early infancy, would, if properly cultivated and encouraged, increase with their increase of years, and be to them, through the whole course of their lives, an increasing and ever-flowing fountain of rational pleasure and improvement? Not that they would all become expert scientific naturalists, but they would all become such careful and philosophical observers of nature, as to be able to understand and admire its order, and beauty, and harmony, and to trace therein the power, and wisdom, and goodness of its Divine Author.

But has there been anything done, any measures taken, to encourage and perpetuate, through childhood and youth and up to manhood, that taste and fondness for natural history which are so universally developed in infancy? On the contrary, the general course of the training of children in school has hitherto been such as was calculated to obliterate, or suppress, this taste—such as was calculated, practically, to impress upon their minds the notion, that those natural objects which had made them so happy in infancy, were the mere *toys of that early period*, which were unworthy to engage their attention, or be remembered in the more advanced periods of childhood and youth. To spell words without knowing their meaning, to read sentences with fluency, without understanding them, to recite the geography of the countries of the world, while their thoughts ranged no farther than the maps before them —exercises like these have usually absorbed nearly the whole time of children in the school-room, and, practically, deprived them of the means and motives for understanding, appreciating, and enjoying what is real, and valuable, and beautiful in the productions of the natural world around them.

But it is hoped that, in this respect, a better day is now dawning upon our country, and that the time is not far distant, when instruction in natural history shall occupy its true place, and receive its due share of attention in all our schools and seminaries of learning. The facilities for illustrating this branch of knowledge are abundant and available in every neighborhood; and let the pupils in our schools be encouraged in collecting them, and aided in examining and understanding them, and they will at length acquire such habits

of careful observation and discrimination, as will be of incalculable service to them in after life. As their knowledge of the objects and phenomena of nature increases, there will be a constant increase of the pleasure of observing its variety, and beauty, and harmony; and they will, in time, become so thoroughly imbued with the *spirit of the naturalist*, that they will go forth from the school-room to their rural occupations, prepared to derive enjoyments from them, which none but the student of nature can know. Although very few of them may be expected to become familiar with the minute details of natural history, yet they will all have acquired such tastes and habits, and so much knowledge, as will make them always interested and delighted with objects, and aspects, and operations of nature around them. When they go forth into the field with the plough, the hoe, the sickle, or the scythe, where the ordinary laborer is cheered onward by no other motive, or object, than pecuniary gain—the hope of well-filled barns, and granaries, and cellars—they, in addition to these more sordid motives, will be animated, delighted and more amply rewarded by observing the manifold workings of that beneficent Providence, which so liberally rewards them for all their toil. The observance of the genial influence of sun and rains—the process of vegetation through all its stages of growth and decay—the transformations, and changes, and habits of insects, and other animals, and their relations to the business and interests of the farmer—in short, the enlightened contemplation and study of the countless variety of the Creator's works, are constantly leading them to rejoice in the contemplation of the infinite wisdom and goodness of the Almighty Creator.

Notwithstanding the prevailing general indifference to the subject of natural history in country places, this indifference is by no means universal. Many there are, in various parts of the country, who, in spite of education, (or the want of it,) delight in watching and tracing the various operations of nature, and who have acquired by their own individual observations, a large amount of knowledge of the productions and objects around them; but who for the want of instruction, and books, and specimens, are, for the most part, unable, successfully, to push forward their labors, or so to arrange their results, as to make them serviceable to others. And yet I have known persons in the backwoods of Vermont, while wholly unacquainted with natural history as a science, acquire by their personal attention and observation, so much knowledge of the habits of insects, and birds, and other animals of their neighborhood, as to be able to furnish to the naturalist positive and valuable additions to science. And even some of our uninstructed housewives, by their habits of careful discrimination in the process of cooking, obtain so accurate a knowledge of various animals used for food, as might sometimes enable them to put the professed comparative anatomist to the blush for his ignorance.

I have spoken of the exclusion of natural history from our schools as the great cause of the general apathy and indifference to that subject in country places. The same cause is, perhaps, equally operative in towns and cities; but these latter possess, in their easy access to large libraries and cabinets, and in their wider range and greater facilities for the collection of specimens through the avenues of commerce, advantages of which they, who may desire to cultivate natural history in the country, are entirely deprived.

The great obstacles in the way of the cultivation of the natural sciences in the country, where there is a disposition to do it, are the want of suitable books and collections, and the want of time to use them. The people of Vermont are mostly agriculturists, who cultivate their farms with their own hands, and who depend upon the productions of the soil for their subsistence; and being thus obliged, "in the sweat of their brow to eat their bread," they have very little time to spare for any other pursuit. Even if good public libraries and collections were at hand, very few could find leisure from their necessary occupations, for the researches, among a multiplicity of books, which would be required in the successful prosecution of any one department of natural history. But of libraries and collections of natural history there have hitherto been none in Vermont which deserve the name, and for the want of them, many a tyro, who had entered with ardor upon some favorite branch of natural history, has become discouraged and obliged to relinquish the pursuit in despair. Ten years ago, a respectable library for the use of a naturalist could not have been culled from all the public and private libraries and all the bookstores in Vermont; and although there has been, since that time, great improvement in this respect, the deficiency of works on natural history, in our public libraries, is still very great.*

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* It is not to be inferred from these remarks, that we have no good public libraries in Vermont. The remarks have been made with particular reference to deficiencies in the department of Natural History. The library of the University of Vermont, though numbering only about 8,000 volumes, is, perhaps, one of the best

In the illustration of this matter, I must beg the indulgence of the Society with a little of my own experience. I will confine myself to the department of ichthyology; but it was nearly the same in all the other departments.

When I first turned my attention to the ichthyology of Vermont, the only scientific work on fishes within my reach, was Dr. Mitchell's paper on the fishes of New York, contained in the first volume of the Transactions of the New York Philosophical Society. With that work only for my guide, I labored long and hard to determine the species of fishes inhabiting the waters of Vermont, and with how little success I labored, they who are acquainted with that work need not to be informed. At length, through the kindness of my friend, the Hon. G. P. Marsh, now United States Minister at Constantinople, I was presented with the third volume of Dr. Richardson's Fauna Boreali Americana; and about the same time, my friend, Dr. D. H. Storer, presented me with a copy of his excellent Report on the Fishes of Massachusetts. Subsequently, I have obtained Dr. DeKay's Report on the Fishes of New York, and some few other works, and have had access to portions of the Journals of *this Society*, and of the New York Lyceum of Natural History, and of the Academy of Natural History at Philadelphia; but, till within the past year, I have not had the benefit of a single specimen from abroad to aid me by way of comparison.

Experiencing so many difficulties myself, and knowing others to be laboring under like embarrassments, I

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selected libraries, in reference to general literature, to be found in the country, and is, probably, more valuable than many public libraries which contain twice the number of volumes.

reflected much upon the possibility of a remedy for them. I saw at once that adequate private or public libraries could not be had in the country on account of their great expense; and that, if they existed, very few, in an agricultural community, could spare the time which would be requisite to consult them, to any profit, on matters of practical natural history, in the present diffused and scattered condition of the materials of that science. I also perceived that the new discoveries in the natural sciences were promulgated through so great a variety of publications, as to render it utterly impossible for a person engaged in the cultivation of natural history in the country to keep himself informed of the progress of discovery in any particular branch of the science.

Under these circumstances, the best remedy for the evils I have mentioned, which presented itself to my mind, was the formation of a national natural history society, of which all the societies of natural history in the country should be auxiliaries. An important part of the business of this society should be the publication of full and accurate manuals of the different departments of natural history, in which all the materials of each should be posted up and arranged in their proper order; and, after that, the preparation and publication, from time to time, of journals of the progress of science in its several departments, compiled from the papers and doings of the auxiliary societies, and other authentic sources. Manifold, as it appeared to me, would be the advantages of such a plan. It would enable the smaller societies, which have not the means of publishing their proceedings, to make known to the world all the valuable results of their labors. It would bring

together, in order, all that is now known in each department of natural history, and it would furnish a ready and cheap means of keeping pace with the progress of discovery. Being calculated for general circulation, large editions would be required, by which the cost would be so much diminished as to bring them within the reach of all who might be inclined to use them.

For persons who can devote but little time to the subject of natural history, such manuals and journals, with such collateral helps as could easily be obtained, would be much more serviceable than large libraries without them. They would be always at hand, furnishing a systematic view of the whole science; and they might be consulted during the respites from labor, for information respecting the objects which had fallen under their observation in the field.

While revolving in my mind the plan I have faintly sketched, with scarcely any hope that it would ever be realized, I was much gratified to learn, about three years ago, that the Smithsonian Institution at Washington was making arrangements for the publication of reports of the progress of science, almost precisely on the plan which had suggested itself to me. I was gratified, because I knew the Institution possessed the means, and, I presumed, the disposition also, to furnish these reports at so cheap a rate as to place them within the reach of every tyro in natural history in the country. Let this Institution publish manuals also, in which all the important facts in the several branches of natural history are carefully posted up to the commencement of the reports, and let these, too, be furnished cheaply to all who will use them; and, if I am

not greatly mistaken, the Institution would in that way do very much "for the increase and diffusion of knowledge among men," and would thus effectually aid in accomplishing the benevolent objects of its founder.

I feel, gentlemen, that I have trespassed too long upon your kind indulgence, and wearied you with details in which you can have felt but little interest; and yet, I have dwelt upon few of the many advantages which would result from a more general diffusion of the knowledge of Natural History through the country, and from a more general spirit of inquiry on the subject. Much might be said of the cultivation of Natural History as a source of individual enjoyment. Paradoxical as it may seem, it enables us to lead a life of *pleasure*, while we are at the same time pursuing a life of *business*. It refines and improves our moral sensibilities, and sharpens and invigorates our intellectual powers. It promotes health of body, by inducing habits of cheerfulness and serenity of mind. It enlarges our views of the Divine power, and wisdom, and goodness, and awakens continual gratitude to God for the rich provision he has made for our support and happiness here, and for training and fitting us for that *new* earth, which we hope to inhabit hereafter.

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